

In the claims:

1. A process for producing a molded article made of fiber-reinforced thermoplastic material, the process comprising the steps of:
  - knead melting a composition comprising a thermoplastic material in its solid state and reinforcing fibers, wherein the thermoplastic material of the composition has a melt flow index of at least 25 g/10 minutes and wherein the reinforcing fibers of the composition have an average length greater than 0.375 inch and are sized with a material which contains at least one polymer from the group which includes polyurethane, polyurea, and thiocyanate derivatives thereof, wherein the reinforcing fibers are filamentized in an essentially homogeneous dispersion throughout the solid polymeric material;
  - transferring the knead melted material into a suitable closed cavity mold device; and
  - upon solidification, removing a finished article from the mold device.
2. The process of claim 1 wherein the thermoplastic material is a polyolefin.
3. The process of claim 2 wherein the thermoplastic material is a polypropylene.
4. The process of claim 2 wherein the composition further comprises a functionalized polyolefin.
5. The process of claim 1 wherein the reinforcing fibers are present in an amount greater than 30% by weight.
6. The process of claim 5 wherein the reinforcing fibers are present in an amount between 35% and 55% by weight.

7. The process of claim 6 wherein the reinforcing fibers are at least one from the following group: glass fibers, carbon fibers, alumina fibers, metallic fibers, ceramic fibers and aramid fibers.

8. The process of claim 7 wherein the reinforcing fibers further include at least one of the following fibers co-mingled therewith: nylon, polyester and polypropylene

9. The process of claim 8 wherein the reinforcing fibers are glass and are present as discrete lengths of at least 0.5 inches.

10. The process of claim 8 wherein the sizing compound contains at least one of the group which includes polyurethane, polyurea, and isothiocyanates derivatives thereof

11. The process of claim 1 wherein the knead melting step occurs in an a device capable of achieving a compression ratio between 2.0: 1 and 2.9:1.

12. The process of claim 11 wherein the device contains a three-section screw having a length, the three-section screw having an initial feed zone, an intermediate transition zone and a final metering zone, wherein the feed section comprises between 23.0 to 28.0 % of the total screw length, the transition section comprises between 47.0 to 67.0 % of the total screw length, and the metering section comprises between 9.0 to 26.0% of the total screw length.

13. The process of claim 12 wherein the knead melting proceeds at a temperature sufficient to melt the thermoplastic polymer into a mass sufficient to surround and encase the oriented reinforcement fibers present in the initial admixture.

14. The process of claim 13 wherein the introduced material experiences a gradual temperature increase up to and through the temperature sufficient to melt the thermoplastic material.

15. The process of claim 14 wherein the maximum temperature achieved is between 450° F and 650°F.

16. The process of claim 15 wherein the temperature maximum achieved is sufficient to initiate melting of the sizing material associated with the reinforcement fibers.

17. The process of claim 16 wherein the finished article is a molded part composed of at least one thermoplastic polymer containing a quantity of reinforcement fibers dispersed in an essentially uniform manner therein, the reinforcement fibers oriented in a filamentized relationship to one another and at least a portion of the fibers having an average length of at least 0.5 inch.

18. The process of claim 17 where in the molded part contains a thermoplastic polyolefin and wherein the reinforcement fibers are at least one from the following group including glass fibers, carbon fibers, alumina fibers, metallic fibers, ceramic fibers and aramid fibers.

19. The process of claim 17 where in the reinforcement fibers are glass fibers present in an amount greater than 30% by weight.

20. A process for producing a molded article made of fiber-reinforced thermoplastic material, the process comprising the steps of:

admixing thermoplastic material in its solid state with reinforcing fibers, wherein the thermoplastic material has a melt flow index of at least 25 g/10 minutes and includes at least one of the group which includes polyamides, polyesters,

polyolefins, polycarbonates, thermoplastic polymer alloys, and wherein the reinforcing fiber has an average length at least 0.375 inch and are sized with a material which contains at least one polymer from the group which includes polyurethane, polyurea, and thiocyanate derivatives thereof, wherein the reinforcing fibers are filamentized in an essentially homogeneous dispersion throughout the solid polymeric material;

knead melting the admixed thermoplastic material and oriented reinforcing fibers for an interval sufficient to achieve melting of the thermoplastic material, wherein the knead melting step occurs in a device capable of achieving a compression ratio between 2.0: 1 and 2.9:1;

transferring the knead melted material into a suitable closed cavity mold device; and

upon solidification, removing a finished article from the mold device.

21. The process of claim 20 wherein the device contains a three-section screw having a length, the three-section screw having an initial feed zone, an intermediate transition zone and a final metering zone, wherein the feed section comprises between 23.0 to 28.0 % of the total screw length, the transition section comprises between 47.0 to 67.0 % of the total screw length, and the metering section comprises between 9.0 to 26.0% of the total screw length.

22. The process of claim 21 wherein the thermoplastic material is a polyolefin.

23. The process of claim 22 wherein the thermoplastic material is a polypropylene.

24. The process of claim 22 wherein the thermoplastic material includes a functionalized polypropylene polyolefin..

25. The process of claim 24 wherein the reinforcing fibers are present in an amount greater than 30% by weight.

26. The process of claim 25 wherein the reinforcing fibers are present in an amount between 35% and 55% by weight.

27. The process of claim 26 wherein the reinforcing fibers are glass and are present as discrete lengths of at least 0.5 inches.

28. The process of claim 25 wherein the sizing compound contains at least one from the group which includes polyurethane, polyurea, and isothiocyanate derivatives.

29. The process of claim 20 wherein the admixing step occurs in a vertical ribbon blender.

30. The process of claim 20 wherein the admixing step comprises:  
introducing the thermoplastic resin and the reinforcing fiber into a premixing vessel, wherein the premixing vessel having an outer wall and at least one rotational mixing element at least one directional orientation device extending inward from the outer wall, in a manner sufficient to orient and direct movement of the introduced thermoplastic resin and reinforcing fiber within the vessel interior, and wherein the thermoplastic resin and reinforcing resin both are introduced into the premixing vessel in a solid and essentially dry state and maintained in said state during residence in the premixing vessel;

fluidizing material introduced mixing vessel by subjecting the introduced thermoplastic resin and reinforcing fiber to a rotational force inducing by the at least one rotational mixing element, wherein the rotational force is sufficient to subject the introduced material to centrifugal force in a vertical axis and bring the introduced material into contact with the at least one directional orientation device;

maintaining the agitated material in contact with the rational mixing element and at least one directional orientation device for an interval sufficient to achieve dispersion of the reinforcing fiber throughout the solid polymeric material and to filamentize the reinforcing fibers in an orientation essentially parallel to flow induced in the premixing vessel.

31. The process of claim 30 wherein the admixing step further comprises: after the premixing step has been completed, conveying the admixed material from the premixing vessel to a knead melting apparatus, the conveyance proceeding in a manner which preserves the reinforcement fibers in an oriented and dispersed fashion relative to the polymeric material.

32. The process of claim 31 wherein the conveyance of the admixed material into the knead melting apparatus occurs immediately upon completion of the admixing step.

33. A process for producing a molded article made of fiber-reinforced thermoplastic material, the process comprising the steps of:  
admixing thermoplastic material in its solid pelletized state with glass reinforcing fibers, wherein the thermoplastic material contains a major portion of polypropylene and a minor portion of functionalized polypropylene, the thermoplastic material having a melt flow index of at least 25 g/10 minutes, and wherein the glass reinforcing fibers have an average length greater than 0.375 inch and are present in an amount greater than 30% by weight, the glass reinforcing fibers are sized with a material which contains at least one compound from the group including polyurethane, polyurea, and isothiocyanate derivatives thereof, and wherein the glass reinforcing fibers and the thermoplastic material are subjected to centrifugal orientational agitation in the vertical axis such that the glass reinforcing fibers are filamentized in an essentially homogeneous dispersion throughout the solid pelletized polymeric material;

knead melting the admixed thermoplastic material and oriented reinforcing fibers for an interval sufficient to achieve melting of the thermoplastic material, wherein the knead melting step occurs in a device capable of achieving a compression ratio between 2.0: 1 and 2.9:1, wherein the device has at least one ;

knead melting the admixed thermoplastic material and dispersed oriented reinforcing fibers for an interval sufficient to achieve melting of the thermoplastic material;

transferring the knead melted admixture into a suitable mold device; and  
removing a finished article from the mold device.

34. The process of claim 33 wherein the reinforcing fibers are present in an amount between 35% and 55% by weight.

35. The process of claim 34 wherein the knead melting step occurs in an multi-zone extrusion device having a compression ratio between 2.0: 1 and 2.5:1 and a three-section screw having a length, the three-section screw having an initial feed zone, an intermediate transition zone and a final metering zone, wherein the feed zone comprises between 23.0 to 28.0 % of the total screw length, the transition zone comprises between 47.0 to 67.0 % of the total screw length, and the metering zone comprises between 9.0 to 26.0% of the total screw length.

36. An article composed of an injection moldable polymeric material, the injection moldable polymeric material comprising:

a melt processible thermoplastic material having a melt flow index of at least 25 g/10 minutes;

reinforcement fibers having a cumulative length distribution frequency is at least 5% of fibers having lengths 10 mm, the reinforcement material having a sizing compound associated therewith, the sizing compound including at least one polymer from the group including polyurethane, polyurea, and isothiocyanate derivatives

thereof, the reinforcing material is present in an essentially uniformly dispersed manner in which individual fibers in a filamentized manner in an amount greater than 30% by weight:

wherein the article has at least one cantilever and a tensile strength at break at least 20,000 psi.

37. The article of claim 36 wherein the cantilevered article demonstrates low tensile creep and high tensile fatigue resistance has a tensile strength at yield of greater than 20,000 psi.

38. The article of claim 37 wherein the reinforcement fiber is at least one from the group which includes glass fibers, carbon fibers, ceramic fibers, metallic fibers, alumina fibers and aramid fibers and the sizing contains thermoplastic polyurethane.

39. The article of claim 38 wherein the reinforcing fibers are glass and are present in an amount between 35% and 55% by weight.

40. The article of claim 38 wherein the reinforcement fiber is glass and the article is a battery tray.

41. The article of claim 40 having a mounting bracket adapted to hold an ABS module therein, bracket being contiguously attached to the battery tray.